MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2018/2019

TES3141 – EXPERT SYSTEMS

(All Sections / Groups)

22 OCTOBER 2018
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 5 pages with 4 questions only.
2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.

QUESTION 1

(a) An Expert System (ES) is a very successful computer system that emulates, or acts in all respects, with the decision-making capability of a human expert. It has been deployed in various industries such as medicine, finance, science, and engineering. Briefly describe FOUR advantages of deploying an ES in an organization.

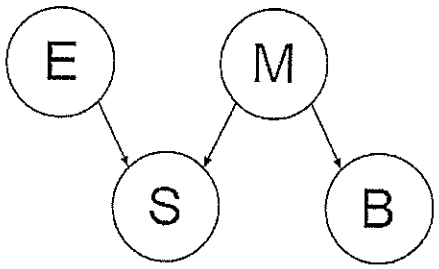
[4 marks]

(b) A smell of sulphur (S) can be caused either by rotten eggs (E) or as a sign of the doom brought by the Mayan Apocalypse (M). The Mayan Apocalypse also causes the oceans to boil (B). The Bayesian network and corresponding conditional probability tables for this situation are shown below.

$P(E)$	
$+e$	0.4
$-e$	0.6

$P(M)$	
$+m$	0.1
$-m$	0.9

$P(S\|E,M)$			
$+e$	$+m$	$+s$	1.0
$+e$	$+m$	$-s$	0.0
$+e$	$-m$	$+s$	0.8
$+e$	$-m$	$-s$	0.2
$-e$	$+m$	$+s$	0.3
$-e$	$+m$	$-s$	0.7
$-e$	$-m$	$+s$	0.1
$-e$	$-m$	$-s$	0.9



$P(B\|M)$		
$+m$	$+b$	1.0
$+m$	$-b$	0.0
$-m$	$+b$	0.1
$-m$	$-b$	0.9

i. Compute P(-e, -s, -m, -b) from the joint distribution. [2 marks]

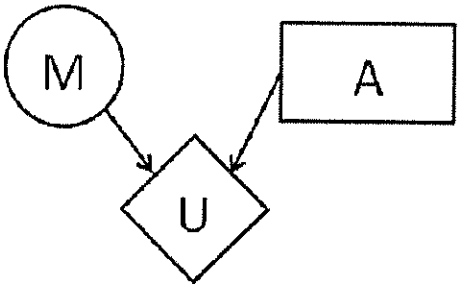
ii. Compute the probability that the oceans boil, P(+b). [2 marks]

iii. Compute the probability that the Mayan Apocalypse is occurring, given that the oceans are boiling, P(+m|+b). [2 marks]

Continued...

QUESTION 2

(a) The new Josh Bond Movie (M), Skyrise, is premiering later this week. Skyrise will either be great (+m) or horrendous (-m); there are no other possible outcomes for its quality. Since you are going to watch the movie no matter what, your primary choice is between going to the theater (theater) or renting (rent) the movie later. Your utility of enjoyment is only affected by these two variables as shown below:



M	P(M)
+m	0.5
-m	0.5

M	A	U(M,A)
+m	*theater*	100
-m	*theater*	10
+m	*rent*	80
-m	*rent*	40

Compute the following quantities:

i. Expected Utility, EU(theater) [2 marks]
ii. Expected Utility, EU(rent) [2 marks]
iii. Maximum Expected Utility, MEU({}) [1 mark]
iv. Which action would you recommend? Justify your answer. [1 mark]

(b) Draw a frame system for laptops. Consider their characteristics like name, manufacturer, operating systems, specialization (a-kind-of / is-a), and owner. Include one instance with filled slots.

[4 marks]

Continued...

QUESTION 3

(a) Study the following information carefully.

IF	sky is clear	
AND	the forecast is sunny	
THEN	the action is "wear sunglasses"	CF = 0.8

Assuming that

CF (sky is clear) = 0.9
CF (the forecast is sunny) = 0.7

Calculate CF(the action is "wear sunglasses"). [1 mark]

(b) Study the following information carefully.

IF	sky is overcast	
OR	the forecast is rain	
THEN	the action is "take an umbrella"	CF = 0.9

Assuming that

CF (sky is overcast) = 0.6
CF (the forecast is rain) = 0.8

Calculate CF(the action is "take an umbrella"). [1 mark]

(c) Given the following information:

IF A is X
THEN C is Z
$CF_{rule1} = 0.8$

IF B is Y
THEN C is Z
$CF_{rule2} = 0.6$

Assuming that

CF (A is X) = 0.9
CF (B is Y) = -0.7

Calculate $CF_{combined}(CF_{rule1}, CF_{rule2})$. Justify your answer based on the certainty factors. [4 marks]

Continued...

(d) Examine whether each of the following statements is a tautology, contradiction or contingency.

i. $(p \wedge \sim q) \leftrightarrow (p \rightarrow q)$ [2 marks]

ii. $(p \vee q) \wedge \sim (p \wedge q)$ [2 marks]

QUESTION 4

Given the rules:

Rule 1: IF *practice piano* THEN *pass piano exam.*
Rule 2: IF *practice piano* THEN *fail piano exam.*

and assuming that:

p = pass piano exam
f = fail piano exam
$\Theta = \{p, f\}$
$m_1(p) = 0.7$ $m_1(\Theta) = 0.3$ for Rule 1
$m_2(f) = 0.4$ $m_2(\Theta) = 0.6$ for Rule 2

(a) Produce the Dempster-Shafer table showing the combination of evidence. [2 marks]

(b) Calculate the combined mass (before normalization). [1.5 marks]

(c) Calculate κ. [2 marks]

(d) Calculate the combined mass (after normalization). [1.5 marks]

(e) Calculate the combined belief function. [1 mark]

(f) Calculate the plausibilities. [1 mark]

(g) Calculate the evidential intervals. [1 mark]

End of Paper